Forest Pest Management Report

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Intermountain Region, State and Private Forestry

# Biological Evaluation of Epidemic Douglas-fir Bark Beetle Populations on the Logan Ranger District, Wasatch-Cache National Forest

By
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## INTRODUCTION

Excessive Douglas-fir, *Pseudotsuga menziesii var. glauca* (Beissn.) Franco, mortality due to epidemic populations of Douglas-fir bark beetle, *Dendroctonus pseudotsugae* (Hopkins), has occured in several north-facing tributaries of the Logan River (Figure 1). These stands are located within the Bear/Hodges management unit, Logan Ranger District, Wasatch-Cache National Forest. Original identification of tree mortality centers was from 1992 9"x9" 1:15840 color aerial photography. Drought, wildfire, snow avalanche, western spruce budworm defoliation, endemic Douglas-fir bark beetle populations, and resident fungi have all been predisposing factors on this landscape which have led to the current outbreak.

The Douglas-fir beetle has one generation annually. Adults and larvae overwinter. Overwintering adults emerge and attack from April to June. Some adults reemerge and attack additional trees, creating a second brood. Adults from overwintering larvae emerge and attack in July and August. Red or yellowish boring dust in bark crevices or around the base of a tree indicate an attack. Seldom are pitch tubes formed but resin may stream down the bole from upper attacks. It is common for woodpeckers to work on trees containing larvae which is sometimes helpful in diagnosis. Individual tree crowns do not fade until the season following attack, making remote detection less than timely.

Variable radius plot sampling in six stands totaling 640 acres was used to determine extent, current, and future status scenarios of these populations. A sanitation/salvage entry on a landscape level would lower populations of the Douglas-fir bark beetle. Residual stand basal areas combined with sanitation of insect populations would increase long term health of affected stands.

## METHODS

Four stands were delineated from 1992 resource photography as being infested in the Bear/Hodges management unit. Two additional stands were selected for high percentage of Douglas-fir and were not known to have beetle populations. Variable radius plots were located at 5 or 10 chain intervals along transects within each stand. Basal area factor (BAF) was chosen at each stand in attempts to average 5 sample trees per plot. Stands 1 and 2 used a BAF of 30 and stands 3 thru 6 used 40 BAF. Species, diameter breast height, and tree/insect condition were recorded. Non-infested Douglas-fir age and height sample trees were chosen by a second prism swing of 62 BAF at each plot center. Stand statistics were obtained by running data through INDIDS (Insect Disease Damage Survey).

## RESULTS

The four stands identified from the 1992 resource photography have populations of Douglas-fir bark beetle (Figure 2a-c). The two stands sampled that were not known to have beetle populations did not. Table 1 lists attacked trees per acre by year of attack and suggests two expanding populations and two declining populations.

Table 2 shows Douglas-fir basal area as a percentage of total stand basal area pre and post outbreak and lists pre and post outbreak total stand basal area. Stands with over 50% basal area in suitable host are more likely to support epidemic populations.

Table 3 lists average diameter of Douglas-fir and average age for each stand. Stands with average diameter greater than 14 inches and average age of over 120 years are considered high hazard especially if they have sufficient basal area.

## DISCUSSION

All stands surveyed were and continue to be moderate to high hazard of sustaining a Douglas-fir bark beetle epidemic population. One of the 4 stands has gone from high hazard to moderate hazard as a result of the current outbreak. Average stand diameter decreases as the beetle populations select large diameter trees first. New centers of mortality can be expected to occur as suitable host remains within the landscape, and predisposing factors continue to occur. Implementation of aerial sketchmapping and ground survey inventories are the best methods to detect new epidemic centers. These methods are laborious but necessary in monitoring beetle activity. The beetle population will continue to have an opportunity to expand in the field season 1994. There is suitable host type throughout existing infested centers. Weather during the winter of 1993 - 1994 was mild. Healthy larvae were observed during field surveys in the months of November, December, January, February, and March.

## Management Options

1. No Action. This alternative allows infestation and tree losses to continue until the populations crash naturally. Estimates of stand losses can be approximated through population surveys. Fire hazard will increase and visual quality may be compromised via this alternative.

2. Direct Suppression. Involves individual tree treatment. This could include; removal of infested trees, treating infested trees with a chemical insecticide, or felling and burning infested trees. Chemically treated trees can be salvaged at a later date.

3. Salvage Logging. Both currently infested and dead trees would be removed. This alternative would utilize the dead material and assist in suppressing local populations. This alternative does not change stand conditions that influence stand susceptibility to Douglas-fir bark beetle attack.

4. Sanitation/Salvage Logging. This alternative combines removal of infested and dead trees, and uninfested susceptible trees in a stand. Also, pheromone baits can be placed on Douglas-fir marked for removal to increase and concentrate attacks. These baited trees must be removed to reduce the beetle population. Stand conditions are made unfavorable for future epidemic populations, but visual impacts may be compromised. Stand composition including average stand diameter of less than 12", average age of less than 150 years, basal area of less than 80 $ft^2$/ac and less than 60% Douglas-fir puts a stand at low hazard of sustaining a Douglas-fir bark beetle epidemic.

5. Sanitation Logging. This alternative focuses on removal of green trees in areas where no current beetle population exists but hazard is high should beetles get these sites. Select for removal of trees older and of larger diameter and hazard can be reduced. As mentioned above, residual basal area of less than 80 $ft^2$/ac, average stand diameter of less than 12", and average stand age of less than 150 years are targets for hazard reduction. Species composition changes would also reduce hazard but may be difficult to implement in this area.

## CONCLUSION

A sanitation/salvage logging alternative is recommended in stands with known beetle populations to reduce tree mortality over the next few years (stands 1-4). Selecting a sanitation/salvage alternative for stands currently infested will reduce insect populations and retain a residual green tree component. Crown thinnings applied to high hazard stands will reduce stand hazard rating, but care must be taken to not leave a residual stand of suppressed smaller diameter trees. The sanitation logging alternative is recommended for stands 5 and 6. This will reduce stand hazard over the longer term, and allow the resource manager more opportunities for resource management rather than allowing the bark beetles to shape the landscape under outbreak conditions. Five year interval detection inventories would be valuable to allow for early warning of Douglas-fir beetle population increases.

## ACKNOWLEDGEMENTS

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Table 1. Number of trees per acre in each condition class.

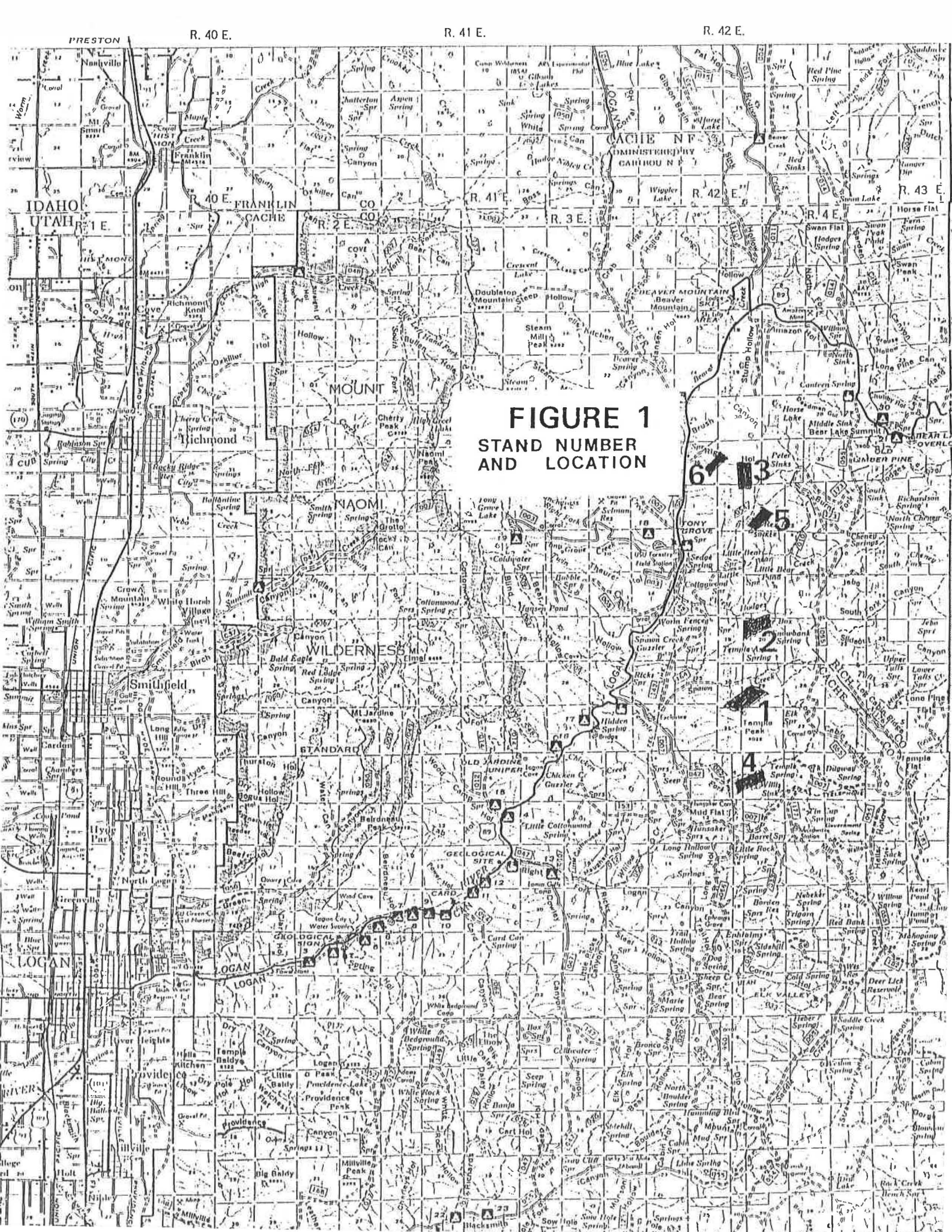
| Stand Number | Diameter Class (in inches) | Trees Per Acre | | | |
|---|---|---|---|---|---|
| | | Live Host | 1993 Attack | 1992 Attack | 1991 and Older Attack |
| 1 | 5-8.9 | 22 | 0 | 0 | 0 |
| | 9-11.9 | 13 | 5 | 0 | 0 |
| | 12+ | 22 | 15 | 7 | 5 |
| | Total | 57 | 20 | 7 | 5 |
| 2 | 5-8.9 | 18 | 0 | 0 | 0 |
| | 9-11.9 | 0 | 6 | 0 | 6 |
| | 12+ | 21 | 4 | 4 | 45 |
| | Total | 39 | 10 | 4 | 51 |
| 3 | 5-8.9 | 35 | 0 | 0 | 0 |
| | 9-11.9 | 0 | 0 | 0 | 0 |
| | 12+ | 66 | 2 | 4 | 24 |
| | Total | 101 | 2 | 4 | 24 |
| 4 | 5-8.9 | 37 | 0 | 0 | 0 |
| | 9-11.9 | 20 | 0 | 0 | 0 |
| | 12+ | 40 | 0 | 1 | 6 |
| | Total | 97 | 0 | 1 | 6 |
| 5 | 5-8.9 | 22 | 0 | 0 | 0 |
| | 9-11.9 | 8 | 0 | 0 | 0 |
| | 12+ | 43 | 0 | 0 | 0 |
| | Total | 73 | 0 | 0 | 0 |
| 6 | 5-8.9 | 25 | 0 | 0 | 0 |
| | 9-11.9 | 40 | 0 | 0 | 0 |
| | 12+ | 65 | 0 | 0 | 0 |
| | Total | 130 | 0 | 0 | 0 |

Table 2. Pre-outbreak versus current conditions of basal area.

| Stand Number | Pre-Outbreak % BA Douglas-fir | Current % BA Douglas-fir | Pre-Outbreak Stand BA (Ft2) | Current Stand BA (Ft2) |
|---|---|---|---|---|
| 1 | 80 | 69 | 139 | 71 |
| 2 | 80 | 66 | 228 | 104 |
| 3 | 82 | 80 | 208 | 140 |
| 4 | 89 | 80 | 120 | 100 |
| 5 | 90 | 90 | 119 | 115 |
| 6 | 62 | 62 | 128 | 128 |

Table 3. Comparison of Douglas-fir pre-outbreak average DBH, current live average DBH, current live age, and hazard rating.

| Stand Number | Pre-Outbreak Avg DBH | Current Live Avg DBH | Current Live Avg Age | Hazard Rating |
|---|---|---|---|---|
| 1 | 14.3 | 12.1 | 168 | Moderate |
| 2 | 17.8 | 16.9 | 167 | High |
| 3 | 15.5 | 14.5 | 250 | High |
| 4 | 13.6 | 12.6 | 106 | Moderate |
| 5 | 16.3 | 16.3 | 269 | High |
| 6 | 15.0 | 15.0 | 100 | High |




# FIGURE 1

## STAND NUMBER AND LOCATION

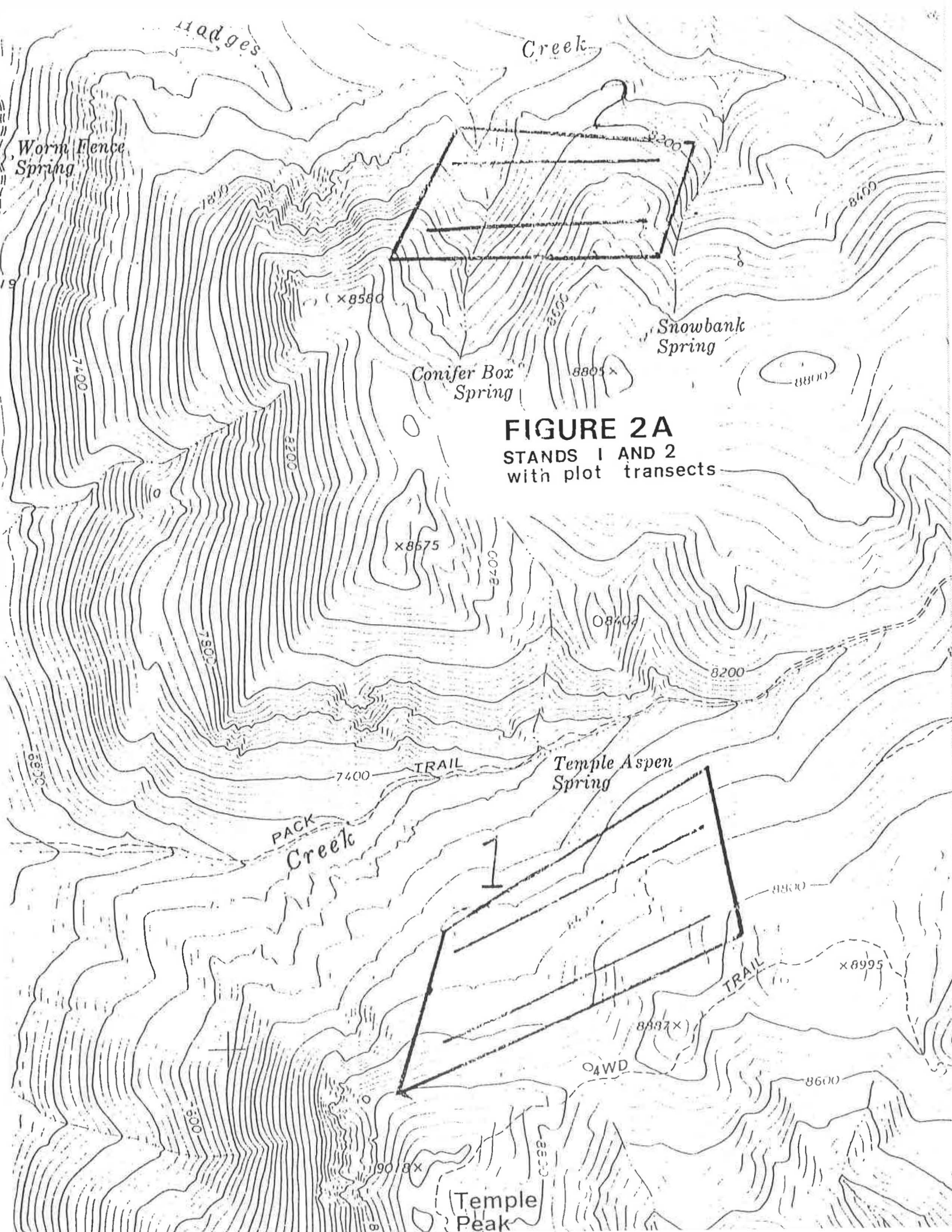



**FIGURE 2A**
STANDS 1 AND 2
with plot transects

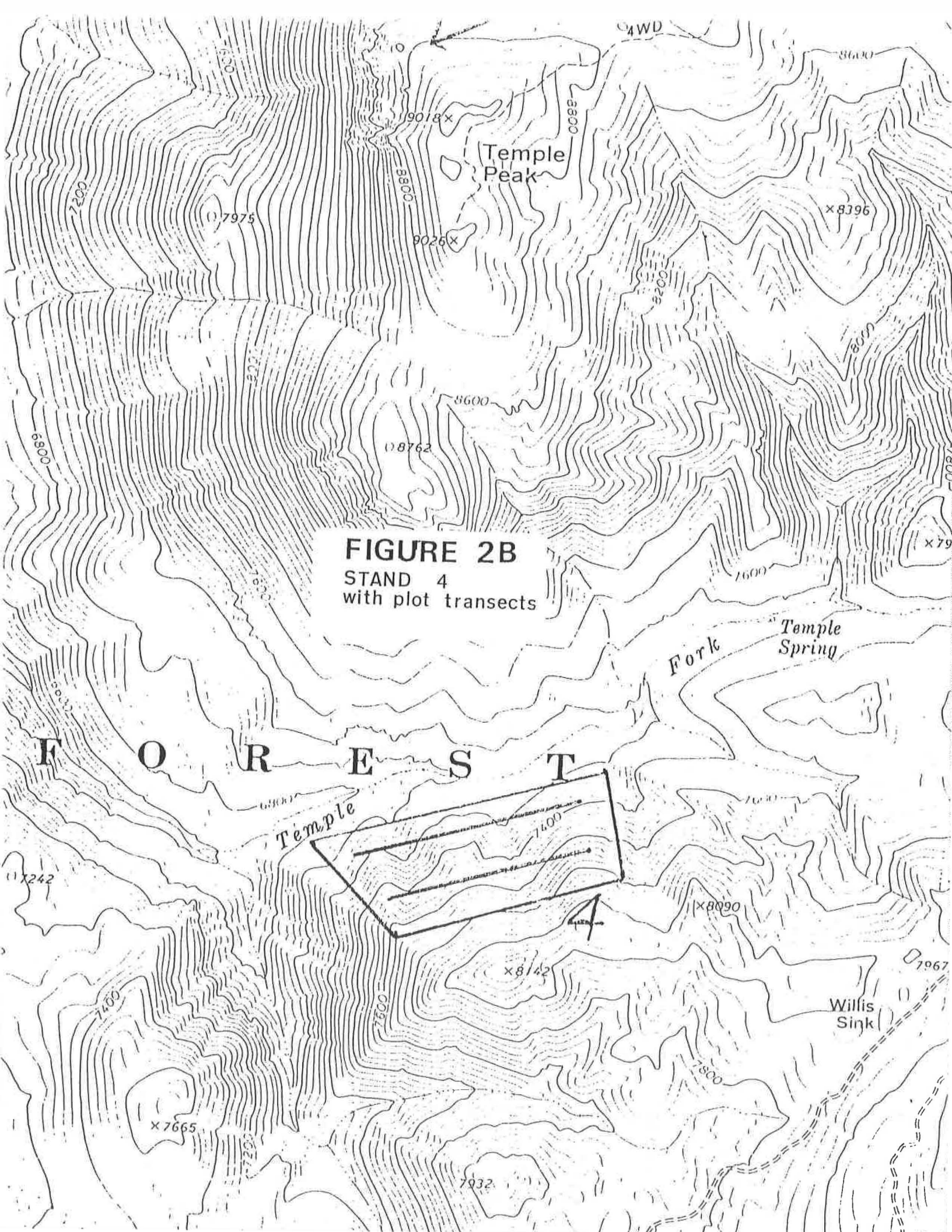



**FIGURE 2B**
STAND 4
with plot transects

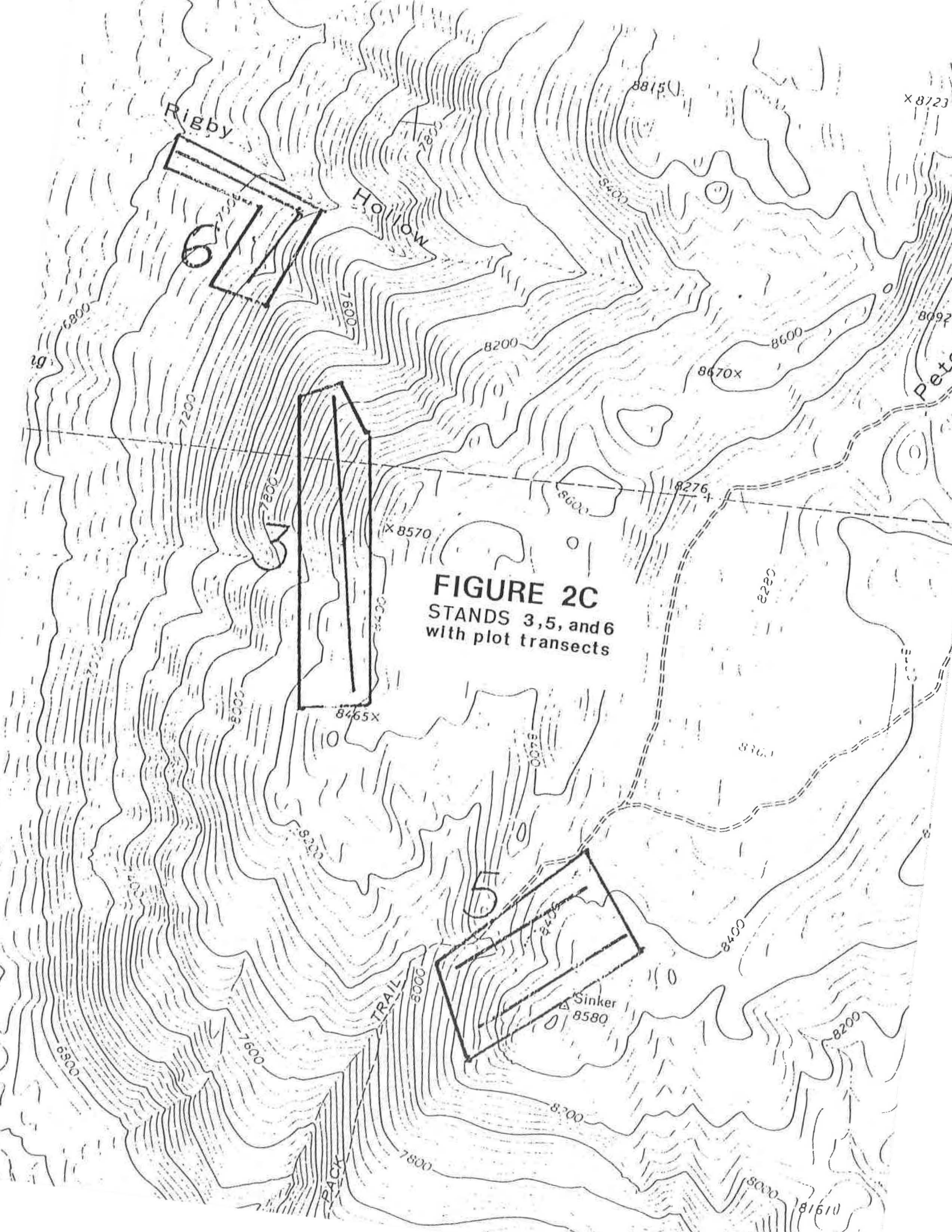



**FIGURE 2C**
STANDS 3, 5, and 6
with plot transects